PATENT ABSTRACTS OF JAPAN

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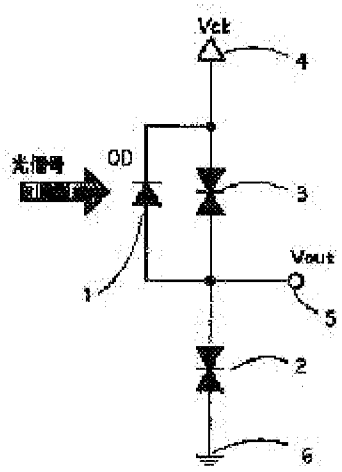
(54) IDENTIFICATION CIRCUIT



(57)Abstract:
PROBLEM TO BE SOLVED: To simultaneously execute optic/electric conversion and an identifying operation and to enable a high speed operation for an optical input signal.
SOLUTION: A resonance tunnel diode 2 as a driver and a resonance tunnel diode 3 as a load are serially connected between a clock supplying terminal 4 and a grounding 6, a photo diode 1 to input an optical data signal is connected in parallel with the resonance tunnel diode 3. Then, an output signal is taken out of a common connection point of the both resonance tunnel diodes 2, 3.

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the discrimination decision circuit which identifies the optical data inputted in an integrated circuit, and is changed into an electrical signal.
[0002]
[Description of the Prior Art]Conventionally, what was shown in drawing 10 is known as a system which identifies an optical data signal and is changed into an electrical signal. This system is used by optical communications. In this system, the photo-diode 21 receives a lightwave signal and it changes into an electrical signal. After the changed electrical signal is amplified with the preamplifier 22 and the post amplifier 23, it is inputted into the discrimination decision circuit 24.
[0003]
[Problem(s) to be Solved by the Invention]However, the interface circuit for light/electrical conversion was required in the system which identifies the above-mentioned conventional optical data input signal, and is changed into an electrical signal. Since the preamplifier 22, the post amplifier 23, and the discrimination decision circuit 24 were constituted by the transistor, rate-limiting [of the speed performance of these circuits] was carried out to the speed performance of the transistor. For this reason, rate-limiting [of the speed performance of the system which identifies an optical data signal and is changed into an electrical signal] was carried out to the speed performance of the transistor.
[0004]This invention is made in view of the above points, and the purpose is to provide the discrimination decision circuit which inputted the optical data signal and made possible identification operation in the high frequency band.
[0005]
[Means for Solving the Problem]The 1st invention for attaining the above-mentioned purpose carries out common connection of one end of load, and the anode of a photo-diode to the other end of tunnel diode with which one end was grounded, Common connection of the other end of said load and the cathode of said photo-diode is carried out to an electric clock supply terminal, an optical data signal is inputted into said photo-diode, and an electric output signal was taken out from a common node of the other end of said tunnel diode, and said load. In the 1st invention, said load constituted the 2nd invention so that it might be another tunnel diode. In the 1st invention, said load constituted the 3rd invention so that it might be resistance. In the 1st invention, said load constituted the 4th invention so that it might be the transistor which an emitter connected with a gate, sauce, or a base too hastily.
[0006]
[Embodiment of the Invention]
[A 1st embodiment] Drawing 1 is a figure showing a 1st embodiment of this invention. As for the resonant tunneling diode as load, and 4, the photo-diode which receives the light from optical data input receive section OD one, and 2 are [an electric-generating-power terminal and 6] groundings an electric clock signal supply terminal and 5 the resonant tunneling diode (RTD) as a driver, and 3 among a figure. Like a graphic display, the series connection of the resonant tunneling diodes 2 and 3 is carried out between the clock supply terminal 4 and the grounding 6, and multiple connection of the photo-diode

1 is carried out to the resonant tunneling diode 3 as load. The output voltage signal Vout is acquired between the electric-generating-power terminal 5 and the grounding 6.
[0007](a) of drawing 2 and (b) are the explanatory views of this discrimination decision circuit of operation. The voltage-current characteristic curve in which A has a negative resistance portion of the resonant tunneling diode 2 among a figure, Since B is the load curve which united the characteristic of the voltage-current characteristic curve which has a negative resistance portion of the resonant tunneling diode 3, and the photo-diode 1 and this resonant tunneling diode 3 is load, the curve B serves as the curve A and a symmetric figure. The intersection of this load curve B and a voltage axis is equal to the clock voltage Vck supplied to the clock supply terminal 4.
[0008]The clock voltage Vck of this clock supply terminal 4 follows on changing on a High level from a Low level, and moves the load curve B from the left of drawing 2 (a) and (b) to the right, i.e., the high-tension side. On the contrary, when the clock voltage Vck changes on a Low level from a High level, it moves to the left from the right.
[0009]In the case where light is irradiated by the photo-diode 1 in the case of movement of the load curve B (Data=High). As shown in drawing 2 (b), it moves, after the current value of the load curve B has become large, and the operating point C (it is the point that the two curves A and B cross, and the voltage here is the voltage Vout to grounding of the output terminal 5.) changes to the high-tension side in connection with it. On the contrary, by the case (Data=Low) where light is not irradiated, the current value of the load curve B moves without changing, and the operating point C stops at the low-voltage side.
[0010]Drawing 3 is a signal waveform diagram showing operation of this discrimination decision circuit. The state of the light at the time of the standup of the clock voltage Vck is identified, and the clock voltage Vck holds the discernment state between High levels. If the clock voltage Vck is set to a Low level, output voltage will certainly change to the low-voltage side. In the above result, the waveform of the output voltage Vout serves as RZ (Return ToZero) signal. In the bistable circuit (there are the two operating points) using a resonant tunneling diode, since the service voltage to that bistable circuit is equal to clock voltage, that this clock voltage is set to a Low level means that the service voltage to a bistable circuit is set to a Low level. By drawing 2 (a) and (b), that it is a service voltage Low level to a bistable circuit supports the figure of the state where the clock voltage Vck is small, and it cannot take only a Low level as the operating point C. Therefore, the clock voltage Vck is not dependent on the optical data to input between Low levels, and the output voltage Vout serves as a Low level.
[0011]100 Gbit/s and an output turn up the waveform of the simulation of DEMUX operation of 50 Gbit/s every 100ps, and optical input data carries out overwrite of drawing 4. In this drawing 4, although it is not what is called an "eye pattern" (waveform by which a Low level and a High level exist in a straight line respectively, and a transition level is inserted between them in an X type), this is because an output is RZ signal. In this RZ signal, after the data of High or Low, since it certainly returns to a Low level before moving to the following data signal, continuation of a High level is not seen like usual. Surely an output signal carries out overwrite of the output to random input data (seven steps of PN) every 100ps. It can check that DEMUX operation has accomplished.
[0012]Here, although the example of DEMUX operation was given, identification

operation is possible by what a clock frequency is made into the same value as an optical input data bit rate for (refer to drawing 3). When DEMUX operation divides the data row transmitted every n pieces, one of them is identified, and the n-1 remaining pieces repeat the disregarded operation, and perform it. That is, data is taken up and identified at the fixed interval. Therefore, since identification operation is included in DEMUX operation, it can be said that the discrimination decision circuit operates by the check of DEMUX operation.

[0013]As mentioned above, in the discrimination decision circuit of this embodiment, since the bistable circuit of the resonant tunneling diodes 2 and 3 which perform identification operation is directly linked to the photo-diode 1 which receives a lightwave signal, the interface circuit of light/electrical conversion becomes unnecessary. Since the resonant tunneling diode 2 which was excellent in speed performance as compared with the transistor is used, operation more nearly high-speed than the conventional discrimination decision circuit using a transistor is attained.

[0014][A 2nd embodiment] Drawing 5 is a figure showing the discrimination decision circuit of a 2nd embodiment. The same numerals were given to the same thing as drawing 1. A different place from the composition of drawing 1, the resonant tunneling diode 3 as load is the point of being replaced with the resistance 7.

[0015]Drawing 6 is an explanatory view of this discrimination decision circuit of operation. When load changed to the resistance 7, the load curve which united the characteristic of the load resistance 7 and photo-diode 1 of the is the straight line D. When light is irradiated, the current value of the load curve D increases because photoelectric current flows. Therefore, if light is irradiated at the time of the standup of a clock, the operating point C will move to the high-tension side, as shown in (b) of drawing 6. Conversely, since the load curve D moves without changing a current value when light is not irradiated, the operating point C becomes the low-voltage side, as shown in (a) of drawing 6.

[0016]In the discrimination decision circuit of this 2nd embodiment, optical input data turns up the output wave of the simulation of 100 Gbit/s and DEMUX operation of an output of 50 Gbit/s every 100ps, and drawing 7 carries out overwrite. It can check that DEMUX operation has accomplished also here. Here, although the example of DEMUX operation was given, identification operation is possible by making a clock frequency into the same value as an optical input data bit rate.

[0017][A 3rd embodiment] Drawing 8 is a figure showing the discrimination decision circuit of a 3rd embodiment. The same numerals were given to the same thing as drawing 1. A different place from the composition of drawing 1, the resonant tunneling diode 3 as load is the point of being replaced with the transistor 8. This transistor 8 is a transistor made to connect an emitter with a gate, sauce, or a base too hastily.

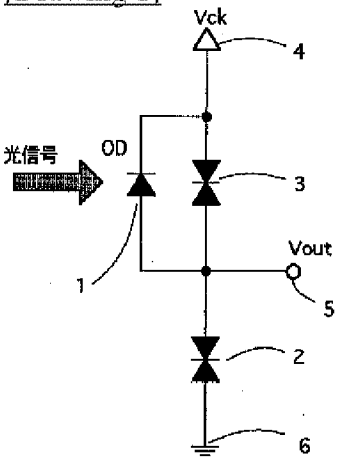
[0018]Drawing 9 is an explanatory view of this discrimination decision circuit of operation. When load changed to the transistor 8, the load curve is E. When light is irradiated, the current value of the load curve E increases because photoelectric current flows. Therefore, if light is irradiated at the time of the standup of a clock, the operating point C will move to the high-tension side, as shown in (b) of drawing 9. Conversely, since the load curve E moves without changing a current value when light is not irradiated, the operating point B becomes the low-voltage side, as shown in (a) of drawing 9.

[0019][Other embodiments] In addition, as for this, although the resonant tunneling diodes 2 and 3 were used above, it is needless to say that it is replaceable with the usual tunnel diode.

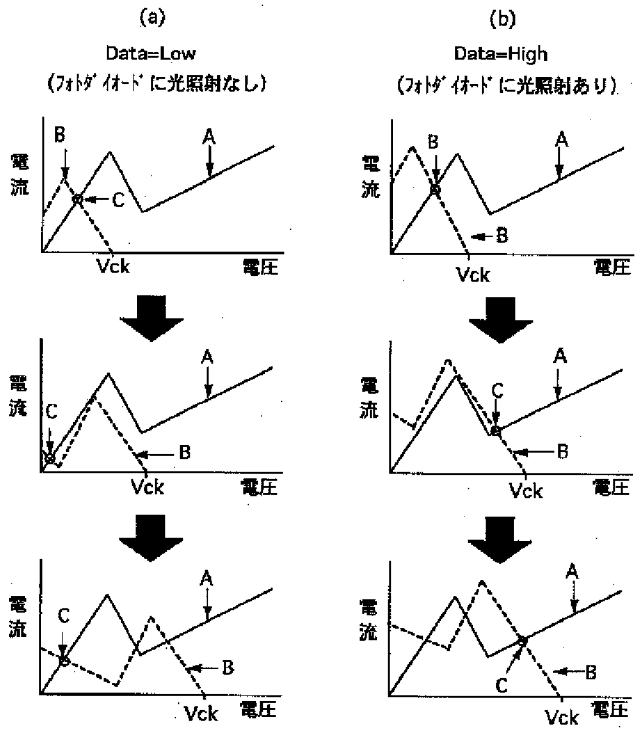
[0020]

[Effect of the Invention]As mentioned above, since the photo-diode for current abnormal conditions is added to the bistable circuit using tunnel diode according to this invention, light / electrical signal conversion, and identification operation can be simultaneously performed to the optical input signal which has a high frequency component.

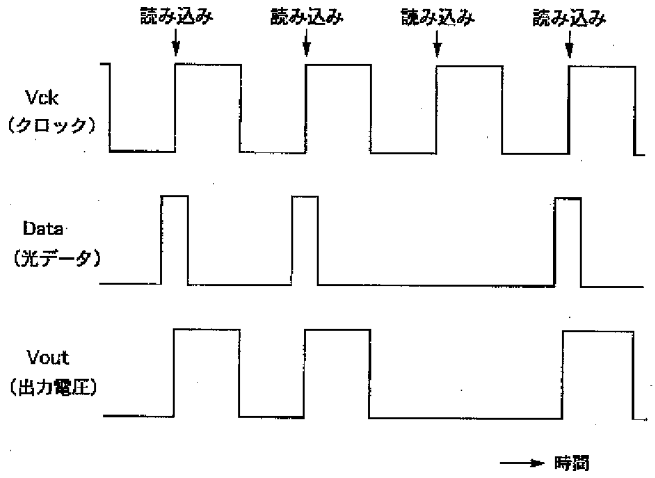
[Drawing 1]



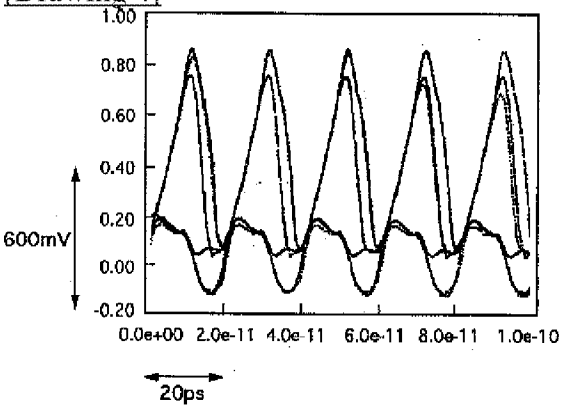
[Drawing 2]



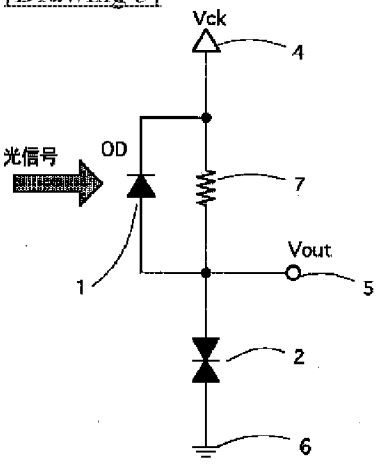
[Drawing 3]



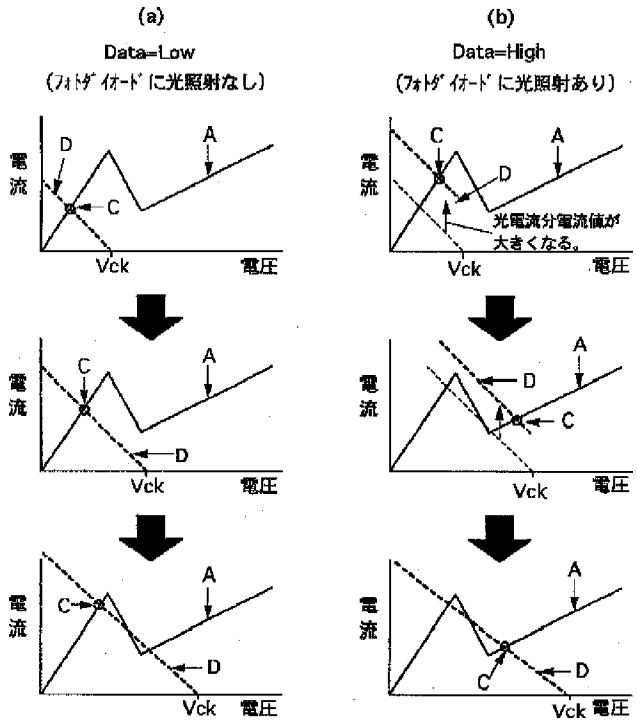
[Drawing 4]



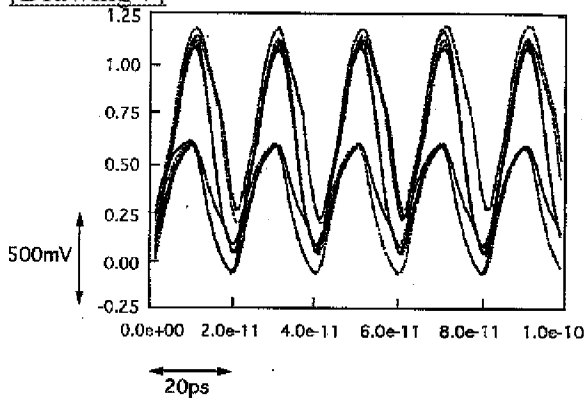
[Drawing 5]



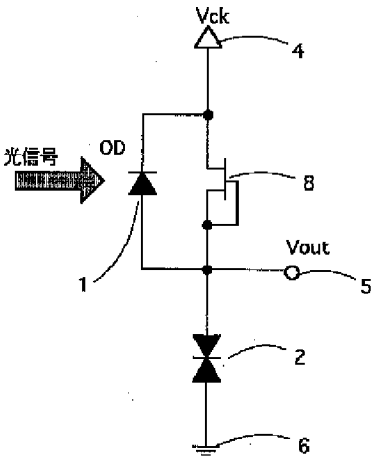
[Drawing 6]



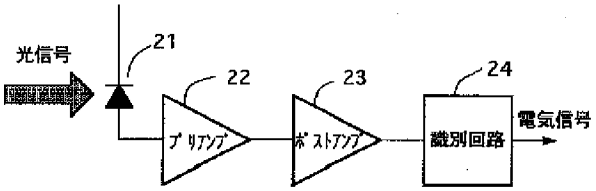
[Drawing 7]



[Drawing 8]



[Drawing 10]



[Drawing 9]